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COUNTRY: India

SUBJECT: Changing the Face of India: 102 River Valley Projects Among  
World's Largest

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1. "Irrigation works including bunds, anicuts, small dams and irrigation canals, built centuries ago are still actively contributing to food production in various parts of India. In keeping with the then comparatively limited needs of the population, irrigation structures were built to suit small communities. With the passage of time, however, the picture began to change; and since the middle of the last century if not earlier, population has over taken food yields from irrigated and unirrigated areas. Signs of shortage began to be markedly felt after the first World War and became acute during and after the second. Our annual deficit now is about four million tons or six to seven millions if the rains fail.
2. "Cheap food grains were in past decades available from Burma and other neighboring sources. Various historical factors and the continued fall in imports from normal sources however brought the matter suddenly to a head in 1942. The partition of the country in 1947 accentuated the position, since a disproportionate share of the cultivated land went to Pakistan. Of the 33 million acres of irrigated land fed by State-controlled canals in undivided India, a little more than half now lies in Pakistan.
3. "To meet the situation India, in addition to buying heavily food from abroad, turned to measures such as reclamation of land for cultivation, distribution of better seeds, use of better implements and manures and improved methods of farming. While these have their place in the production programme, crops must have adequate quantities of water at specific times of their life cycles in order to produce normal yields -- and are thus dependent on the monsoon. Irrigation facilities not only free the cultivator from the vagaries of the monsoon but enable him to double and at times even treble his yield through repeated cropping.
4. "The quantity of water that flows annually through Indian rivers to the sea is enough to cover the entire area of the Indian Union to a depth of two feet. But less than two inches of this enormous quantity has so far been harnessed for food and power production. This meagre quantity, however, includes most of the perennial flow of the snow-fed rivers of the North. Of the underground resources, no authoritative estimates have yet been made, but their exploitation is comparatively expensive and is resorted to only if other means are not available or difficult to exploit.

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5. "The bulk of the surface flow is available during the monsoon only. Assured and adequate supplies throughout the year for larger areas can therefore be provided, if this seasonal surplus could be stored during the rainy season and released during dry periods when most of the channels carry little or no discharge. By this means, besides extension of perennial irrigation to vast areas, floods which cause considerable damage to life and property every year can be controlled, facilities for water transport extended and huge blocks of hydroelectric power generated which would enable the development of industry.

"PLANS FOR THE FUTURE

6. "The long range and lasting solution of the country's problem of food production and economic development therefore lies in pushing ahead with multi-purpose river valley projects. That this is fully realized is evidenced by the Planning Commission's assigning the highest priority to the utilization of the country's water resources for irrigation and power projects in the first Five-Year Plan. Nearly a third of the total budget of Rs.1500 crores for the Plan has been earmarked for river valley projects, and some of these are among the world's largest.
7. "India's natural waterways are more or less evenly distributed over the entire territory. A rough survey of the possibilities of utilization of our water wealth has revealed that the irrigated area can be doubled within the next 15 to 20 years. Hundreds of miles of waterways can be made navigable, and power to the extent of 30 to 40 million kilowatts generated. Additional food produced would not only cover the present deficit but also provide to some extent for the future growth of population.

"102 PROJECTS

8. "The first Five-Year Plan provides for the execution of 102 projects spread over the country, designed to extend irrigation to 8.84 million acres and provide a million KW of additional hydel power within the period. Ultimate benefits will be the extension of irrigation to 16.5 million acres and additional power of 1.8 million KW.
9. "An all-India picture of the current progress made with river valley projects may be obtained from the following:

"Bhakra-Nangal Dam Project

"The principal features of this project are: Construction of a main storage dam 680 feet high -- the world's highest straight gravity dam -- on the river Sutlej near Bhakra, about 50 miles upstream of Rupar where the river enters a narrow gorge: a diversion dam at Nangal about eight miles downstream; a hydel canal with two power houses and a network of canals to irrigate annually over 34 million acres in a cultivable area of over 56 million acres.

"The Nangal dam has already been constructed. It is designed to divert the requisite supplies from the Sutlej to the Nangal Hydel canal and to provide a balancing storage to form up variations in supply due to load fluctuations at the Bhakra Power Plant.

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Construction of the hydel canal from Nangal to Rupar has also made considerable progress. A total of 144 thousand KW of power will be generated at the two power houses on the hydel canal. The first power station is under construction and is expected to be completed by March 1954.

"Delhi is to be supplied with power from this Project. The Nangal-Delhi Transmission line survey has been completed and arrangements are under way for laying the lines and constructing grid sub-stations along the route. Delhi may expect power from Nangal in 1954/55.

"Before work on the main Bhakra Dam can be taken in hand arrangements have been made to divert the entire flow of the river from the site of the dam. For this purpose two gigantic tunnels, each 50 feet in diameter, one on either bank, are being constructed. Each tunnel is about half-a-mile long. The pilot tunnels, begun a couple of years ago, are being enlarged and lined. They are expected to be completed by June next.

"Excavation of the canals is also making rapid progress. The channels are expected to be utilized for irrigation well ahead of the completion of the main dam.

#### "Damodar Valley Project

"The need for this project arose from the menace of frequent floods in the deltaic portion of this erratic river. The left bank, on which lie all the communication lines, is protected by a long and heavy marginal embankment. This is breached during abnormal floods. The last breach occurred during the war, in 1943, when land communications between Calcutta and Western India were cut off. As a result of the recommendation of an Enquiry Committee, it was decided to plan for the integrated development of the entire basin, including Valley's land, forest and mineral resources.

"A statutory body, known as the Damodar Valley Corporation, has been constituted by an Act of Parliament to execute the necessary work. It is an autonomous body patterned after the Tennessee Valley Authority in the United States of America. Commensurate with its responsibilities, the Corporation has been endowed with wide powers necessary for the successful implementation of the large undertaking.

"The Project, intended for the benefit of Bihar and West Bengal, envisages the control of the capricious Damodar by impounding its flood waters in a series of reservoirs to be created by the construction of dams across the main river as well as its tributaries. In the first phase of development, which is included in the Five-Year plan, four dams are to be constructed at Tilaiya and Maithon across the Barakar, Panchet Hill on the Damodar and one dam across the Konar. The reservoirs will have an aggregate storage capacity of 2.44 million acre feet. Flood reserves are proposed to be provided at Maithon and Panchet Hill only. This is designed to cut down the highest recorded flood of 650,000 cusecs to about 250,000 cusecs, which the section of the river in the deltaic area can safely carry without flooding its right bank or injuring the embankment on the left. Power will be generated at all the four dams. The installed capacity will be about 124,000 KW. In addition, a thermal plant is being erected in the heart of the valley Bokaro. Its ultimate installed capacity will be 200,000 KW.

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"The regulated flow below the dams will be picked up at Durgapur, where a barrage is to be constructed for diverting the flow into a network of canals designed to irrigate nearly 1,026,000 acres of kharif and 300,000 acres of rabi crops in West Bengal. A part of this canal system will be utilized for navigation purposes also. This will provide an all-water route between the Raniganj coal fields and Calcutta.

"Of the four dams, Tilaiya is likely to be completed by the end of this year and Konar next year. Construction of Maithon was started last cold weather.

"Considerable progress has been made with the construction of the thermal power house at Bokaro. The first unit is expected to come into operation shortly. Construction of the barrage and canals has been taken up.

#### "Hirakud Dam Project

"The Hirakud Dam Project is one of three units envisaged for the development of the Mahanadi Valley. The other two projects will be the Tikarapara Dam and the Narai Dam in the middle and lower reaches of the river. The Hirakud project is designed to control floods in the deltaic area of the valley, irrigate 1.9 million acres of land and generate nearly 200,000 KW of firm power.

"The principal features are a main earth dam across the river about eight miles upstream of Sambalpur, a subsidiary dam at the tail end of the power channel, and a network of flow and lift irrigation canals. Extension of navigation in the river below the dam and construction of a coastal port are also being studied.

"The main dam will be 15,748 feet long with 12.8 miles of low earthen dykes on either side. About 3,850 feet of the dam -- in two sections -- will be in concrete to provide for spillways and a power house. The rest will be in earth. The maximum height of the dam will be 195 feet.

"The reservoir formed behind the dam will have a storage capacity of 675 million acre feet, a water spread of 157,600 acres and a shore line of over 150 miles. Of the total capacity 224 million acre feet will form the dead storage to serve as a silt reserve and to provide the minimum head for power generation. The rest will provide a reserve for moderation of floods and a 'live' storage for irrigation and power development.

"Commenced in 1948-49, the construction of the earth dam, concrete spillway and other major features of the project have made considerable headway. Construction of the left concrete spillway and excavation of the foundation of the right spillway and power house are rapidly proceeding. Earthwork on the left part of the main dam and the dykes is also under way. To enable dam construction in the bed of the river, coffer dams had been built to divert the water flow in non-flood season.

"Lay-outs for the power station and sub-stations and the high tension transmission lines, radiating from Hirakud have been finalized, and more than a third of the work on the 650 miles of irrigation canals has been completed.

"Among the preliminary works executed on the project are a 25-span road and rail bridge across the Mahanadi, a thermal power house and part of a national highway built on the Project.

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"A cement factory at Rajaangpur with a capacity of five hundred tons a day to supply cement for the project has just been completed. It came into production in the first week of July. A thermal station to provide motive power for the factory, with a capacity of three thousand KW, has also been installed.

"Alongside dam construction, steps are being taken on to transport people displaced from the Hirakud reservoir area on new lands reclaimed from suitable territories nearby. The pace of work on the project as a whole has gathered momentum, and the first irrigation waters are expected to flow into the fields by 1956.

#### "Kakrapur Weir

"This will be the lowermost project in the integrated development of the Tapi river basin. The Weir will be about 2,175 feet long and 45 feet high above the deepest river bed. The designs have been finalized and 'vetted' on models. Actual construction is under way.

"Canals, which will aggregate 850 miles, intended to irrigate over 6 lakh acres of land in the Surat district of Bombay, are being excavated. About 460 miles have already been completed.

"The diversion dam and part of the canal system will begin to function for Kharif irrigation in 1953. The development of this project is expected to increase the food yield by 160,000 tons and produce 16,000 tons of additional cotton. The total estimated cost of the project is a little more than Rs.6 crores.

#### "Ghataprabha Canal Project

"This scheme is the first stage on the development of Ghataprabha valley. The canal project consists of the construction of a left bank canal running for about 44 miles from the existing pick-up weir across the Ghataprabha River, in the Belgaum district of Bombay. It will provide seasonal irrigation to about 100,000 acres of land. Begun in 1949, the project has already started irrigation over the first eight miles and is expected to be completed in 1955/56.

#### "Gangapur Project

"This is an irrigation project which envisages the construction of a 12,500 foot earthen dam across the Godavari near Gangapur, eight miles west of Nasik in Bombay State. The dam will be 140 feet high, having a waste weir on its left flank to a length of about 500 feet. With an open waste weir, the storage capacity of the reservoir will be 500 million cubic feet, and, after gates have been fitted, it will be able to hold 7,200 million cubic feet of water. The right and left irrigation canals will supply water to about 45,000 acres. Construction was begun in 1949 and is expected to be completed by the end of 1955/56. More than 60 per cent of the total earth work on the dam has already been completed.

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"Mayurakshi Project" (MOR D)

"This project is also being executed in two stages. The first, comprising a diversion barrage at Tilpara near the town of Suri in West Bengal, was completed in the middle of 1951. Two canals, one from either side, take off from the barrage and will irrigate an area of 600 thousand acres. The area commanded is divided into six blocks separated by five rivers -- the Brahmani, the Dwarka, the Mayurakshi, the Bakreswar and the Kopai -- in order from north to south. The canal system was completed to enable two blocks, one on either side of the Mayurakshi river, measuring about 100 thousand acres, to be irrigated during the last kharif season. Smaller barrages across the remaining rivers are under construction, as also channels which will extend irrigation to the ultimate area of 600 thousand acres.

"Rainfall and, consequently, the river flow in the area are very erratic. A storage dam is, there, necessary in order to obtain the maximum benefit from the scheme. A suitable site is available about 20 miles upstream of the barrage site. The second stage envisages was taken up last cold weather. It will be 125 feet in height at its deepest portion and will impound about 500 thousand acre feet of water. With its completion kharif irrigation for the entire commanded area will be assured as also rabi irrigation for about 100 thousand acres. In addition, it will be possible to generate a small block of power. The installed capacity will be 4,000 KW.

#### "Tungabhadra Dam Project"

"A joint enterprise of Madras and Hyderabad States, the main feature of the project is a 160 foot high masonry dam, nearly 8,000 feet in length, across the Tungabhadra river. One 225 mile main canal taking off from the right bank will irrigate about 250,000 acres in Madras, and a 127 mile canal on the left about 450,000 acres in Hyderabad. Hydroelectric capacity to the extent of 60,000 KW will be installed on the Madras side and 110,000 KW on the Hyderabad side at the dam site and at the falls along the canals.

"Rapid progress is being maintained on the construction of the dam. More than two-thirds of the masonry construction has already been completed. The dam has in places risen to its full height. More than two hundred miles of canal have been excavated and further excavation is in progress. The Hagari aqueduct, a major cross-drainage work on the right bank canal, has also been completed. The project is expected to be completed in 1953/54.

#### "Machkund Project"

"This project is designed to utilize for power generation a gross head of 874 feet on the Machkund river on the Madras-Orissa border. It comprises the construction of a 130 foot high and 1,300 foot long storage dam at Jalaput on the river to store 612,000 acre feet of water; an 80 foot high diversion dam across the river 17 miles below; a conduit comprising a 4,060 foot long concrete channel, a 4,250 foot long free-flow tunnel, a small pond and a 3,000 foot long pressure tunnel to lead the water to the power house. The power house will have three generating units each of 17,250 KW capacity to begin with and six in the ultimate stage. Proposed to be developed in stages, it has an ultimate capacity of 103,500 KW.

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"Construction of the project was begun in 1947. Good progress has been made on the diversion dam and the conduit system. The work is expected to be completed next year.

"Lower Bhavani Project

"A masonry dam about 1,500 feet long and a little more than 200 feet high over the deepest foundations is under construction across the Bhavani, a tributary of the Cauvery. On both flanks of the masonry section earth dams, totalling about 28,000 feet in length, will be built. A 120 mile canal on the right will irrigate 207,000 acres. The project, it is later proposed, will be developed to generate a seasonal power of 10,000 KW.

"Started in 1948, the project is nearing completion and irrigation is expected to begin this kharif season.

"The benefits accruing to the nation at the end of five years work on the projects included in the Five Year Plan will include extension of irrigation to about 87 million acres and development of slightly more than a million KW of electrical energy. Completion of all the projects should step up the additional irrigated area to 16.4 million acres and the power to 1.8 million KW.

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"SCHEMES IN PLAN'S SECOND PART

"There are a number of other major projects vital to the economic growth of the country that have been investigated and found feasible of execution. Construction of these, however, is conditioned by the availability of finance, in addition to the extent of foreign aid and mutual assistance among Commonwealth countries. Of the more important of these projects are the Kosi, Krishna-Pennar, Chambal, Kayna and Ukai schemes.

"Kosi

"One of the most advanced schemes, ripe for execution, is the Kosi Project. The proposal envisages a 120 foot high earth dam at Belka hill nose, nine miles downstream from Chatra. The scheme, roughly estimated to cost Rs.66 crores, will moderate the intensity of the floods and irrigate a total area of 27 lakh acres in Nepal and Bihar. The output from the project could be about 300,000 tons of rice and 700,000 tons of non-food crops, apart from 90,000 KW of hydroelectricity for the benefit of Nepal and Bihar. To begin with, however, it is proposed to provide for the development of only 40,000 KW in the first stage.

"Chambal

"For the development of the Chambal river basin, shared by Madhya Bharat, Rajasthan and Uttar Pradesh, three dams -- one in Madhya Bharat and two in Rajasthan -- and a barrage below Kotab in Rajasthan will have to be built. Detailed designs and estimates have already been prepared for the Ganghisagar dam in Madhya Bharat and the Rawabhatta dam in Rajasthan. Entire development of the basin on these lines is expected to cost about Rs.48 crores. The estimated benefits from this scheme are: Irrigation of 1.2 million acres of land and generation of 1000,000 KW of firm power. To begin with, however, it is proposed to drop the Kotab Dam and part of the transmission system which should bring down the cost to about Rs.38 crores and reduce the benefits by about 50,000 KW of power.

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"Koyna

"To meet the power shortage of Bombay, plans have been drawn up to tap the Koyna, a tributary of the Krishna in Western Chats. The Project will have four units of 60,000 KW and transmission lines will carry power to the Bombay system, the entire scheme costing about Rs.36 crores.

"Ukai

"A tie-up with the Koyna is the Ukai dam proposed across the Tapi in Gujarat, about 16 miles upstream of the Kakrapar weir, now under construction. In addition to an installed capacity of 300,000 KW of power, this Project has an irrigation potential of 529,000 acres of land.

11. "CONTINUOUS DEVELOPMENT

"The nature of the food problem, the growing population and the untapped natural resources of the country are such that the process of development of river valleys has to be sustained for a long period and should follow a planned scheme of organic growth. To maintain a continuity of development in this direction, it is necessary to collect detailed and extensive data regarding the water resources and possibilities of their exploitation. With this object in view, the Planning Commission has earmarked an annual expenditure of 40 lakhs of rupees for systematic investigation of the river valleys in the country so that proposals continue to be put up to the Government for sanction of Projects and assignment of priorities one after another.

"Among the Projects that are at present under active investigation by the Central Water and Power Commission are the Sabarmati, the Ganga Barrage, three projects on the Narmada, namely the Punasa, the Broach and the Tawa, and two on the Mahanadi, namely the Jonk and the Upper Mahanadi. The investigations on the Sabarmati and the Ganga Barrage projects have nearly been completed and proposals are shortly expected to be submitted to the Government.

"Sabarmati

"The Sabarmati project envisages the construction of a dam 127 feet high across the Sabarmati River at Dharoi to impound 0.962 million acre feet of water and irrigate an area of 144,500 acres annually and supply water to the city of Ahmedabad. It will have a firm power potential of 1,265 KW and an average seasonal power potential of 3,500 KW. The power will be utilized in working 520 tube wells to irrigate an additional area of 182,000 acres annually and for supplying electricity to cottage industries and towns and villages. The scheme is estimated to cost Rs.18.22 crores and to yield a return of 5.89 per cent.

"Ganga Barrage

"The Ganga Barrage project envisages the construction of a barrage carrying a railroad bridge across the river Ganga at Farracca for diverting supplies into 27 mile long new navigation canal and a second barrage at Jangipur above the junction of the canal with the Bhagirathi. The completion of the



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project will achieve the objective of providing a direct and perennial navigation route between Calcutta and Bihar and Uttar Pradesh within the Indian territory, river control and a railroad connection between the two portions of West Bengal and also between Assam and the rest of India. This will also provide irrigation facilities for about a million acres of land to areas in West Bengal south of the barrage and supply water for resuscitation of the moribund rivers in West Bengal.

"Punasa, Broach Tawa

"The Punasa, the Broach and the Tawa Projects on the Narmada are expected to provide irrigation facilities for 26 lakh acres and generate 4.17 lakh KW of firm power, whereas the two projects of Jonk and Upper Mahanadi are expected to command three lakh acres of land and produce 10,000 KW of power.

12.

"DIVIDENDS START TO FLOW

"The nation is now investing nearly Rs.100 crores every year on these projects -- more than the total investment so far made on irrigation projects in the Indian Union, but dividends have already started to flow forth. From the middle of last year 100 thousand acres of land began to be irrigated from the Mayurakshi Project. Benefits of a sizeable nature should commence next year."

[Available on loan from CIA Map Library, in connection with [REDACTED] is a map of India upon which the dams -- those projected, under construction and completed - are located.]

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